



National Semiconductor

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## 54LS114 Dual JK Negative Edge-Triggered Flip-Flop with Common Clocks and Clears

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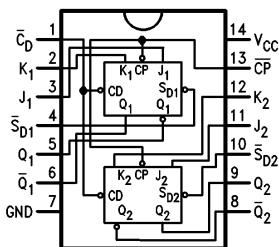
#### General Description

The 'LS114 features individual J, K and set inputs and common clock and common clear inputs. When the clock goes HIGH the inputs are enabled and data will be accepted. The logic level of the J and K inputs may be allowed to change

when the Clock Pulse is HIGH and the bistable will perform according to the truth table as long as the minimum setup times are observed. Input data is transferred to the outputs on the negative-going edge of the clock pulse.

#### Connection Diagram

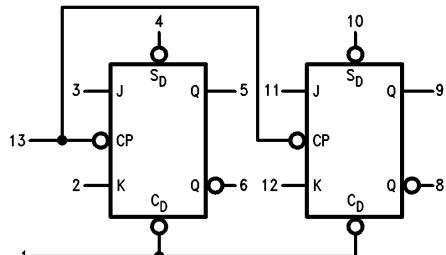
Dual-In-Line Package



TL/F/10176-1

Order Number 54LS114DMQB,  
54LS114FMQB or 54LS114LMQB  
See NS Package Number E20A, J14A or W14B

#### Logic Symbol



TL/F/10176-2

V<sub>CC</sub> = Pin 14

GND = Pin 7

Pin Names	Description
J1, J2, K1, K2	Data Inputs
$\overline{CP}$	Clock Pulse Input (Active Falling Edge)
$\overline{CD}$	Direct Clear Input (Active LOW)
$\overline{SD1}, \overline{SD2}$	Direct Set Inputs (Active LOW)
Q1, Q2, $\overline{Q1}$ , $\overline{Q2}$	Outputs

## Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	
54LS	−55°C to + 125°C
Storage Temperature Range	−65°C to + 150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

Symbol	Parameter	54LS114			Units
		Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	V
V <sub>IH</sub>	High Level Input Voltage	2			V
V <sub>IL</sub>	Low Level Input Voltage			0.7	V
I <sub>OH</sub>	High Level Output Current			−0.4	mA
I <sub>OL</sub>	Low Level Output Current			4	mA
T <sub>A</sub>	Free Air Operating Temperature	−55		125	°C
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time J <sub>n</sub> or K <sub>n</sub> to $\overline{CP}$	20 20			ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time J <sub>n</sub> or K <sub>n</sub> to $\overline{CP}$	0 0			ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	$\overline{CP}$ Pulse Width	20 15			ns
t <sub>w</sub>	$\overline{CD}$ or $\overline{SD}_n$ Pulse Width	15			ns

## Electrical Characteristics

Over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = −18 mA			−1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max, V <sub>IL</sub> = Max	2.5			V
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max, V <sub>IH</sub> = Min			0.4	V
					0.5	
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 10V; J <sub>n</sub> , K <sub>n</sub> Inputs SD1, SD2 Inputs CD Input CP Input			0.1 0.3 0.6 0.8	mA
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V; J <sub>n</sub> , K <sub>n</sub> Inputs SD1, SD2 Inputs CD Input CP Input			20 60 120 160	μA

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

## Electrical Characteristics (Continued)

Over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
$I_{IL}$	Low Level Input Current	$V_{CC} = \text{Max}$ , $V_I = 0.4V$ Jn, Kn Inputs SD1, SD2 Inputs CD Input CP Input			-0.4 -0.8 -1.6 -1.44	mA
$I_{OS}$	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 2)	-20		-100	mA
$I_{CC}$	Supply Current	$V_{CC} = \text{Max}$ , $V_{CP} = 0V$			8.0	mA

**Note 1:** All typicals are at  $V_{CC} = 5V$ ,  $T_A = 25^\circ\text{C}$ .

**Note 2:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

## Switching Characteristics

$V_{CC} = +5.0V$ ,  $T_A = +25^\circ\text{C}$  (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	$R_L = 2k$ , $C_L = 15 \text{ pF}$		Units
		Min	Max	
$f_{max}$	Maximum Count Frequency	30		MHz
$t_{PLH}$	Propagation Delay $\bar{C}P$ to Q or $\bar{Q}$		16 24	ns
$t_{PHL}$	Propagation Delay $\bar{C}D$ or $\bar{SD}_n$ to Q or $\bar{Q}$		16 24	ns

## Truth Table

Inputs		Output
@ $t_n$		@ $t_{n+1}$
J	K	Q
L	L	$Q_n$
L	H	L
H	L	H
H	H	$\bar{Q}_n$

Asynchronous Inputs:

LOW input to  $\bar{SD}$  sets Q to HIGH level

LOW input to  $\bar{CD}$  sets Q to LOW level

Clear and Set are independent of clock

Simultaneous LOW on  $\bar{CD}$  and  $\bar{SD}$

makes both Q and  $\bar{Q}$  HIGH

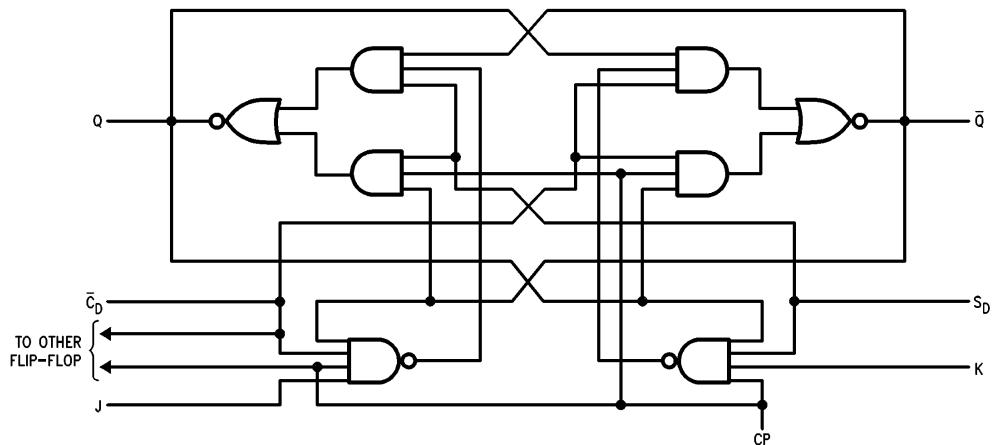
H = HIGH Voltage Level

L = LOW Voltage Level

$t_n$  = Bit time before clock pulse.

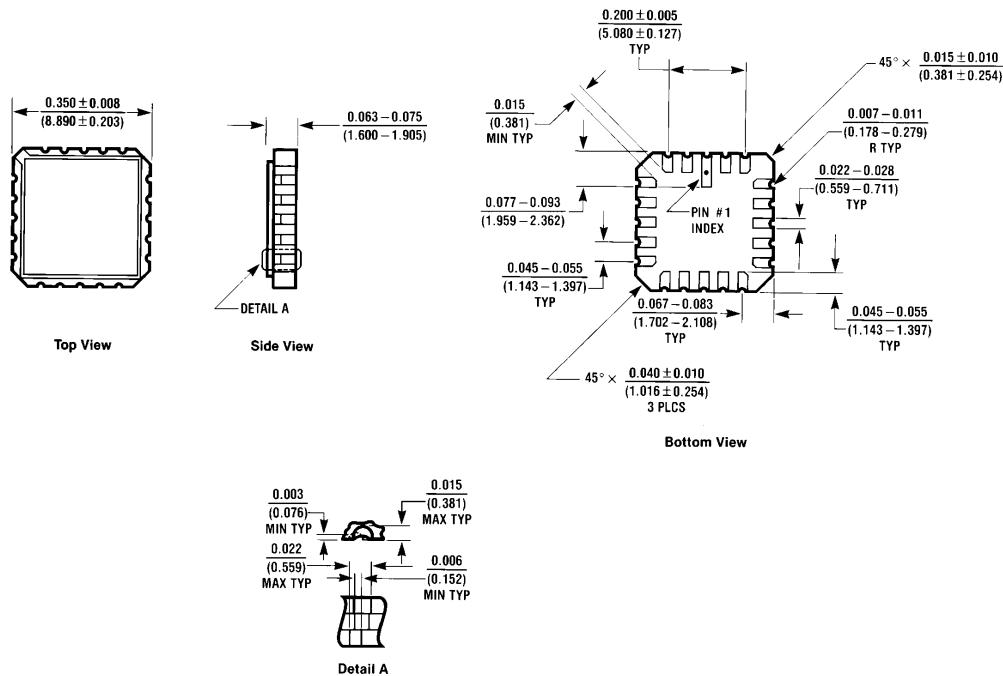
$t_{n+1}$  = Bit time after clock pulse.

## Logic Diagram (one half shown)



TL/F/10176-3

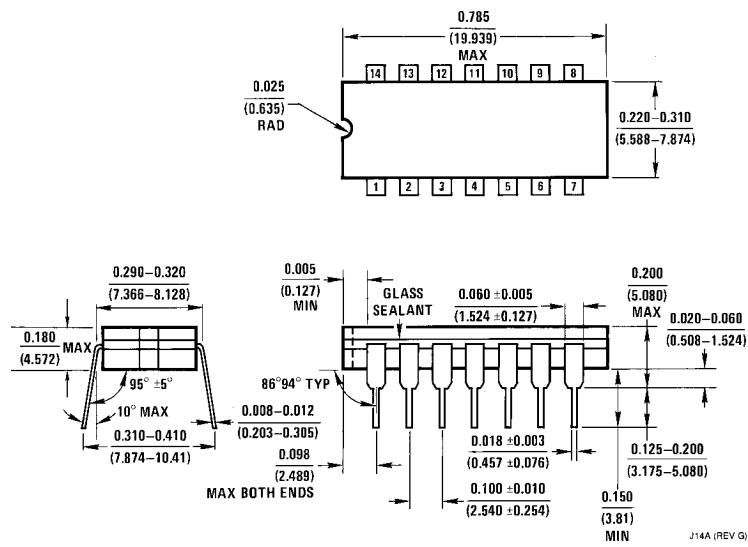
## Physical Dimensions inches (millimeters)



**Ceramic Leadless Chip Carrier (E)  
Order Number 54LS114LMQB  
NS Package Number E20A**

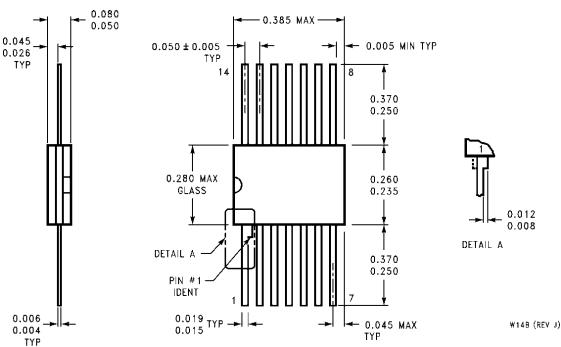
E20A (REV D)

**Physical Dimensions** inches (millimeters) (Continued)



# 54LS114 Dual JK Negative Edge-Triggered Flip-Flop with Common Clocks and Clears

## Physical Dimensions inches (millimeters) (Continued)



**14-Lead Ceramic Flat Package (W)**  
**Order Number 54LS114FMQB**  
**NS Package Number W14B**

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